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# New Human Demands in Industry\*

Mr. Alec Rodger:

Human demands in industry are determined, in the last resort, by economic pressures. These pressures have many origins and many outcomes. So we cannot speak on tonight's topic with any certainty at all. But there is some scope for intelligent hunching and discussion. That is no doubt what we shall all be trying to offer you. I have six points to make.

1. We need not panic about automation or any other development of the kind. For several reasons radical change is not likely to come upon us suddenly. British industry is not composed chiefly of organizations of the size of the United Steel Companies and the Steel Company of Wales. It is made up mainly of far smaller firms with far less capital. Wonderful transfer machines and automatic assembly equipments are not for them; nor are electronic computers. They cannot afford them, though some firms will be able to hire time on computers. Anyway, even our big firms are usually slow to introduce change. And even if they were not, it is likely that, while we pursue a full—or "fairly full"—employment policy, our planners would try to see that changes did not take place with too disrupting rapidity. In short, I believe we have time for inquiry and reflection.

2. However, this is no excuse for setting the problem aside. Even now we are to some extent being taken unawares. New jobs are coming into being; old ones are being modified, partly through the breaking down of demarcation lines drawn between them and other jobs; and the proportion of skilled to unskilled workers in many industries is decreasing. (Almost everybody knows now about the Moscow factory

that has been making pistons for the whole of the Russian light car industry with a shift-team of nine, six of them skilled men.) Undoubtedly, substantial change is already in the air. If we do get caught, we shall no doubt find ourselves developing tremendous feelings of insecurity; and then we *shall* be in trouble. As the *Manchester Guardian* said (March 11th, 1958), "It is the tendency to cling on, to resist the natural process of industrial change, that may turn a recession in a few industries into a general slump."

3. If my first and second points are sound—that is, putting them the other way round, if it is true that important changes are already taking place, but that we still have time to organize ourselves properly—then surely our task is clear. We must make use of our present opportunities to study thoughtfully the implications of these changes for our working population. Let me illustrate. At the present time great expansion is occurring in what is called "programming". Programmers, as many of you will know, are people who plan the work of electronic computers. Now, it is a plain fact that programmers are as assorted a bunch as men ever were. They have come from an extraordinary variety of educational and occupational backgrounds. Take a sample of them, and you will find all kinds of improbable people doing well and badly in this new occupation. Here is a heaven-sent chance for us to do a simple, inexpensive, desirable and thoroughly useful "natural history" study in the occupational field. Why should we not, while we have time, find out what the earlier attainments, interests and circumstances of the programmers have been, with the object of relating the facts we discover to the degree of their success in programming? Then we should be able to say, with far greater confidence than we ever could otherwise, that for programming we want people like

\* A symposium at a Members' Meeting of the Eugenics Society on March 19th, 1958. Unfortunately the Hon. Michael Layton's contribution is not available for publication.

this, not like that. What an advantage this would be in, say, ten years' time, when the game has lost its novelty and its attraction for the eager, restless spirits who, in hope or despair, are trying their hand at it now! By then, controllers of finance and directors of scientific research and development will have become rather tired of *ad hoc*—and sometimes rather expensive—methods of finding and making programmers. They will want to have a reasonably clear picture of the sort (or sorts) of people they should be after, and of where to get them, how to train them, how to supervise them and how to pay them. A few really good interviewers—that is, in this case, interviewers who really know what questions to ask people about their educational and occupational records and their leisure interests—could do a great deal about this quickly and at absurdly low cost.

4. In adopting this approach, not only to programming but to other new occupations gradually coming into being, we should have to be careful about what has been called "criterion trouble". That is, in finding out what attainments, interests and circumstances "go with" success in an occupation, and may be useful in forecasting it, we have to take pains to see that we have differentiated our more successful and less successful workers properly. We cannot afford to make serious mistakes on this fundamental point. Now, it is my view that the only way in which we can do this differentiation well is through the systematic study of what I call "errors and aversions", or "difficulties and distastes". This is not the place to expound my thesis in detail. Let me say this, however. In our attempts to guide people into suitable occupations, to select and train them, to devise suitable methods of work for them and give them suitable equipment, to contrive working conditions which will satisfy them—in all these things, *nothing* is more basic than the study of difficulties and distastes actually experienced by workers in those occupations. These are the keys to our understanding or suitability for *any* occupation. Which aspects of the work are often found to be difficult? What are the aspects of it that people tend to dislike? Everything about an occupation—from the guidance of people into it to the arrangement of

payment schemes for it—depends on the answers we give to these two questions.

5. This contention is not as remote from genetics as might be suspected. For what I am after is the extensive as well as the intensive study of occupational difficulties and distastes, so that we may accumulate knowledge of the most general and most persisting of them. Armed with this descriptive knowledge, we shall be well placed to go forward with investigation of their genetic and other origins. For too long, we who study occupational demands have been content to apply notions worked out mainly in the educational field. If we did research along the lines I have suggested, we might well find something *akin* to the educationists's notion of general intelligence, on which we have for years been basing important conclusions; but I doubt very much whether it would turn out to be as similar to that notion as we have assumed.

6. A major obstacle to progress in matters of the kind is, very often, a sort of conspiracy of silence between employers' associations and trade unions. An illustration of this is to be found in the report, published last month, called *Training for Skill*. It is a considerable feat to get representatives of the British Employers' Confederation and the Trades Union Congress to sign anything jointly, and we should not be too critical if we find them recommending that (for example) "... arrangements should be as flexible as possible", and "... the utmost flexibility is desirable". But it is, I think, disturbing to discover no frank acknowledgment whatever, in this report, of the existence of really seriously restrictive practices in the entry and training of apprentices and in the work of trained craftsmen. Everybody knows—employers and unions included—that these bedevil all planning in the matters we are discussing tonight. The sub-committee of the National Joint Advisory Council which produced the report was chaired by Mr. Robert Carr, the Parliamentary Secretary of the Ministry of Labour, who must have known that the experience of his own Department's Government Training Centres had clearly demonstrated that skilled men for many trades could be trained in a fraction of the time commonly laid down for apprenticeship. So, in our consideration of new

human demands in industry; of the genetics of the characteristics we shall need, if we are going to meet them; and of the education and training we shall have to have, if we are going to bring them out—in our consideration of all these things let us be realistic.

In short, what I have been arguing is that, as we have a chance to study changes which are now taking place fairly slowly, let us seize it and accumulate systematically the information we need about new human demands in industry. Employers, unions and scientists should get together on this, and they could do it quickly and easily. Nobody has any excuse for mishandling the opportunity.

### Mr. R. Peddie:

I am afraid I must disclaim any knowledge of eugenics or of any pretence to being a scientist. My training has been in accountancy and my experience in industrial administration and I can only give you, for what they are worth, the results of my observations in industry as an administrator and also as one who has for some years been responsible for the recruitment and training of staff for my company.

There is, I think, no doubt that the qualities which industry is demanding from its recruits at all levels is changing and that the emphasis on different qualities is changing too.

This process has been a gradual one which has been evolving ever since the industrial revolution took full effect, and has been due in the main to the progressive mechanization of industrial processes. In the past this has been evident chiefly in the elimination of much heavy physical effort, and, with the ever increasing division of labour, in the introduction of routine repetitive manual work.

This has for a considerable time created a situation in which the main requirement from the bulk of the working population has not been a life of sweat and physical toil, but of monotonous routine work calling for detailed concentration and often for certain simple and easily acquired skills of judgement or manual dexterity. I suppose this has demanded a somewhat higher level of education and intelligence than pure manual labour but not to any great extent.

As this development has been due to the growth of mechanization, it has in turn created a demand for a much larger proportion of people capable of servicing and maintaining machinery of every kind; the skilled craftsman who requires considerable training and the intelligence to absorb and apply a fair degree of technical knowledge and the manual dexterity to execute his work.

In addition, the extension of the division of labour, the growth of mass-production and progress in mechanization and in technical methods has greatly complicated the task of supervising and organizing industrial activity. More highly skilled technical specialists and more technical knowledge in supervisors has been required. This has demanded a higher degree of technical training at different levels and also a practical ability to apply this knowledge to the living situation.

I imagine that this has meant a demand for a higher level of intelligence in a greater part of the population, or at any rate a more positive development of the intelligence which is intrinsically there. This demand has not been confined to the technical side.

The increased size of the working unit, the effects of education and of monotonous routine work on the general mass of workers have increased the need from management and supervisors of higher qualities of leadership and greater skill in handling human problems. One hesitates to suggest what exactly are the qualities demanded for this work, but it seems to be a field in which the shortage is most acute.

These developments have been so gradual that their effects have not been immediately apparent, but now it seems that we are on the threshold of a period of great and more rapid change. Scientists of all kinds seem to have broken through many barriers.

The problem of supplies of fuel to permit the ever-increasing use of electric power seems to have been solved for all time, and the application of electricity for every kind of powered movement will receive a great stimulus as a result.

At the same time the development of electronics has introduced seemingly endless possibilities for the application of automatic controls both for single machines and for whole

processes and this may have a revolutionary effect on manpower requirements.

One can visualize the production line of repetitive workers being replaced by transfer machines controlled by planned programmes built up and operated by electronic computers.

We must not exaggerate this possibility; there are many fields of industrial and commercial activity where the unit is too small or the activities too varied to permit the adoption of such methods. But even here there will be progress.

As a nation we are being slowly educated by the general interest in scientific matters, by the gradual spread of such things as work study and by advertisement and propaganda to more efficient working, to the use of labour-saving devices and so on. This should mean that efficiency and productivity will increase gradually, even though it will not mean that the need for large numbers of routine repetitive workers will be eliminated. There should, however, be a decline in the relative demand for them, particularly by large-scale industry.

What will be required in their place?

We can assume that we shall need fewer, though different people for a given output, but by all economic history and logic this will mean an advance in productivity and the standard of living rather than under-employment.

The advance of mechanization has already greatly increased the demand for those who service machines rather than operate them. At a modern steel works, for instance, the number of production workers is already less than half the number of hourly paid employees. This trend must continue. We shall want more skilled maintenance craftsmen and more designers and engineers for this purpose. This is a continuation of an existing trend to which I have already referred. There is likely, however, to be a growing emphasis on a sound knowledge of electricity and electronics.

In addition to the increased need for technicians, the development of automatic controls and the scientific planning and implementation of production programmes will create a demand for types of workers which are almost entirely new. The operation of the push button controls of a self-correcting automatic system may not

make great demands on intelligence or numbers, but there must be people about who understand what is going on and why, and who can take action if matters go awry. We may not require a great many of these "safety men" if I may so call them, but their job will be akin to the very important and complicated task of designing the programmes by which the system will be operated, of planning and organizing the productive flow and of producing the information on which the programmes will be built. Together, they seem likely to form a large and important class of highly skilled and specialized staff.

It is already clear that in many cases the most important and difficult task in installing an automatic system is not the introduction and operation of the automatic equipment itself but in planning the flow of data to the system and modifying or eradicating existing procedures and we cannot limit this new group to system programmers as such.

One visualizes that they will have a number of different but rather similar functions which will demand much the same basic qualities although in different degrees. How are we to train them? If we pass them all through the plant maintenance and development side we shall place a premium on detailed technical aptitudes which may have little relevance to the qualities of imagination, logical thinking and human leadership which may ultimately be needed.

Can we therefore develop this wider knowledge by theoretical studies, leaving the practical side to come with experience on the job?

If this is the answer it surely means that more emphasis will have to be placed on the standard of selection. We shall be saying firmly that leaders and also programmers and interpreters are born and not made, or at least can be developed by theoretical studies.

I find this a dangerous doctrine and wonder what the genetists, psychologists and educationists say about it.

The use of automatic controls and what is known as integrated data processing (i.e. the automatic collection and analysis of costing and production data) introduces another complication.

Mechanization or automation of perhaps

many production processes and of the preparation of the statistical information about their performances will not eliminate the need for managerial decisions, at any rate for a very long time to come, although management may have more accurate and prompter information on which to base its decisions. At present, most information has to be built up, summarized and presented in a form suitable for managerial assessment by manual methods. In fact, the preliminary work of interpretation is done by those who prepare it. This is work calling for experience and intelligence, but in practice it is a by-product of the actual work of analysis, the interpretation and familiarity with detail emerging as the work proceeds.

In future, the interpreters will have to work from completed analyses, but they will still require experience and detailed knowledge to make the correct interpretations, and still more to instruct the programmers to design the system to produce the right information.

Management too may need training to understand how the information is produced in order that its value may be correctly assessed and the best use made of the new tool at its demand.

All this means that the existing methods of training by the build-up of knowledge and judgement through gradually expanding experience will no longer be available in many cases. This difficulty will, I think, arise not only on the office side or with general management but on many other sides as well.

The old school still believes that a man should have done the job he is to supervise and although this is no longer generally possible in practice, the conventional theory of training behind most apprenticeship schemes is that a man should have some practical experience in as many fields of his future activities as possible in order to relate his theoretical knowledge to the actual situation and to appreciate the human factors involved.

When the work is entirely mechanical and automatic, practical experience is hard to gain and human factors are presumably non-existent.

Nevertheless we cannot expect that routine work will be entirely eliminated. Many of the production processes and the analyses of performance will become entirely automatic but

human agencies will be required, not only to plan and control these processes, but to perform some at any rate of the subsidiary operations required to feed the process or produce the basic control data required. This new situation appears to imply that although it will still be possible to start at the bottom, the early rungs of the ladder will be missing. The earlier steps of widening technical experience and expanding responsibility will not be there and the interpreters and controllers and planners will have to be introduced ready made.

What qualities will they need? I doubt if anyone is yet quite sure. But it seems that their intellectual basis will be largely a mathematical and logical one. Their work seems to call for ingenuity and logic in planning, for thoroughness in detail and for ability to visualize a complicated problem as a whole, while many of the techniques used are mathematical ones. I wonder if I dare define much of this as the need for a "crossword" mind. The standard of attainment needed is more doubtful. I have heard it said, on the one hand, that a computer programmer, for example, should have a good degree in mathematics, and on the other that a programmer can be trained in a matter of months from a good "A" level boy. Doubtless, this is due to the wide range in the type of programme required. At the one end is the solution of advanced and complicated mathematical equations. At the other is the programming of routine but extensive works recording or pay roll preparation.

Whatever the standard, however, the qualities required will be similar and this new demand raises a number of questions.

Does a sufficient supply of people of this kind exist?

If not, how can they be obtained?

Will this new field of activity produce another category of "back room boys" or create a "blind alley" career?

If this is a danger, how can it be avoided?

How can we develop in these people the qualities, and provide the training and experience which will enable them later to move into the field of general management?

It seems likely that the new developments in automation will add still further to the many

narrow specialisms that already exist, and make the transition to general management a problem. Can solutions of the problem be suggested?

I am afraid I have not contributed much to your knowledge on this question. I have ventured to speculate on developments in the future and to suggest some of the problems which I think may arise, but I am afraid I must leave the answers to you.

May I summarize what I have said as follows.

Historically, the human demands of industry may be likened graphically to a pyramid of increasing intellectual and personal qualities, the distribution of which seems to have coincided with the supply of these qualities which were available in the population and also with the demands for the progressive extension of responsibility in the conventional industrial hierarchy.

The pattern of distribution seems to have accommodated the switch in demand at the base from purely physical qualities to the simpler mental qualities required by routine repetitive work.

Current developments suggest that the picture of industrial requirements may change from a pyramid to an oval, a figure in which the middle is broader than the base.

Is this a requirement which can be satisfied in practice? Or will these new developments fail for lack of satisfactory human material?

The primary demands seem to be:

1. A larger proportion of trained and skilled craftsmen and what I may call mechanics and electricians.
2. A larger supply of people with a bent for, and training in mathematics and logic.
3. The possibility that, while the managerial function with its demand for wide judgments and the ability to handle human problems may become more complex and more important, the opportunities for practical experience and gradual development of these qualities may be reduced.

I am afraid I cannot say if or how these demands will be met, or even in whose hands the answer lies. Is it in eugenics, psychology or education? That is, can supply be adjusted to the demand?

Or must the reverse be true and will the ball come back into industry's court for it to restrict development to the supply of human material available?

## Dr. Kenneth Hutton:

There seems to be an insatiable demand for men and women possessing qualities of leadership combined with a scientific outlook. What is the probable response of educationists to this demand?

First we must try to ensure that those adults with a scientific outlook (whether trained scientists or not) have their powers of leadership developed and properly utilized. Already there are examples of scientists doing outstandingly good jobs as heads of universities, training colleges and schools, although there is still prejudice against appointing them.

Secondly we must try to influence the unscientific thinking of our existing leaders, because no matter how good the output of our schools, our pupils will not be in positions of authority for another twenty years.

Looking to the future, we must modify our schools' curricula so that an inquisitive, experimental, practical approach to life is inculcated, rather than a slavish acceptance of things as they are. Too many of our leaders learn too little science and start too late to learn it.

If we are in earnest about this, we must encourage education authorities to allow teachers the freedom which they have in an enlightened county like the one I am privileged to work for. Space, and time, are vitally necessary if science teaching is to be of adequate quality. Nearly all maintained schools have inadequate laboratory space and only a niggardly ration of laboratory assistance. Industry has given money to build laboratories for independent schools, and it is a scandal that public money is not forthcoming in a similar way for the maintained schools.

Public opinion needs to be aroused to the iniquity of attempts to put back the educational clock by schemes such as the "Block Grant" which will enforce economy at all costs, whereas on account of the "bulge" more spending is essential if we are even to maintain standards.

## NEW HUMAN DEMANDS IN INDUSTRY

Finally, looking to the farther future, as intelligence is so largely inherited, why is every financial discouragement applied to intelligent parents? Income tax on family allowances; “free education” but a means test for the universities. Altruism is not enough for producing our future leaders, or for fulfilling new demands in industry.

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